

XII. Safety in Elementary School Science

Keys to Safety: Planning, Management, and Monitoring

This chapter provides information to assist the elementary school teacher in maintaining a safe classroom environment for the teaching of science. Safety is an important concern in the elementary science classroom because students are learning new skills and working with unfamiliar equipment and materials that can pose some degree of hazard. Safety in the elementary school science classroom depends on the wise selection of experiments, materials, resources, and field experiences as well as consistent adherence to correct and safe techniques. This chapter – a guide to these safe practices – should be reviewed carefully to avoid accidents.

Safety in the science classroom requires thorough planning, careful management, and constant monitoring of student activities. Teachers should be knowledgeable of the properties, possible hazards, and proper use and disposal of all materials used in the classroom. This information is available through Materials Safety Data Sheets (MSDSs). Federal law requires that vendors of laboratory chemicals provide an MSDS for each substance they sell. The sheets provide detailed information about the physical and chemical properties, proper storage, disposal, toxicology, etc., of substances. The law also requires that MSDSs be available at the worksite.

►See Appendix C, MSDS: Explanation and Samples.

Science activities are diverse and often more difficult to supervise than other instructional activities. Anticipating, recognizing, controlling, and eliminating hazards require knowledge and understanding of safety issues discussed in this safety manual. The information provided in the manual is intended to help teachers present stimulating science lessons in the safest learning environment possible.

SCIENCE SAFETY MANUAL CHAPTER SYNOPSES: CHAPTERS I - XI

Chapter I: Responsibilities. Safe laboratory program require participation by administrators, teachers, students and the community. Administrators need to make available a laboratory area for science activities that is functional and safe. Teachers need to set a good example by being enthusiastic about safety. Teachers maintain a safe science program by exercising good judgment, providing proper instruction and supervision, and maintaining a written record of safety instruction. Students are expected to follow all safety procedures and rules in the safety rules agreement that they have signed. Also, students need to follow all additional instructions their teachers give them concerning the laboratory exercises they perform. The safety rules agreement must also be read and signed by parents, thus ensuring that parents too know and support

TEACHERS ARE RESPONSIBLE FOR . . .

- **exercising good judgment in planning and conducting safe laboratory investigations.**
- **providing students instruction in safe laboratory procedures.**
- **providing supervision for all science activities.**
- **maintaining a written record of student safety instruction.**

the goal of safety in the science classroom.

Chapter II: Legal Aspects of Laboratory Safety. In the event of a charge of negligence in the science laboratory, several parties are potentially liable: the state, the school district, the school board, the school administration, and the teacher. This chapter presents information on the responsibilities the teacher has as the person immediately in charge of pupils in a science activity. Among persons potentially liable, the classroom teacher is most often considered to be placed in the accountable position. Legal action against a teacher stems from the presumption that he or she is the expert in the laboratory and, as such, has the responsibility to ensure that activities are carried out in a prudent and safe manner. The descriptions of and cautions concerning negligent acts are clearly outlined.

ELEMENTS OF LEGAL NEGLIGENCE

- a legal duty of one person to another, as teacher to student
- a breach of this duty
- personal injury or monetary damage caused by the breach of duty
- legal breach judged to be proximate cause of injury or damage

Chapter III: Safety Concerns and Emergency Lab Equipment. Classroom size is a major concern when conducting science activities. There must be a reasonable amount of space for each student and for emergency equipment and storage facilities. Proper maintenance of emergency equipment is essential. Teachers need to know the location and proper use of equipment such as gas and electric cut-offs, fire extinguishers, fire blankets, and eyewash fountains or devices. Materials, storage space, and evacuation routes must be clearly marked. The use of safety goggles is required for many laboratory exercises.

SAFE SCHOOL LABORATORIES HAVE . . .

- adequate work space for students and teachers.
- clearly marked emergency evacuation routes.
- master gas and electric cutoffs.
- properly maintained safety equipment.
- signs and labels to identify safety

A safety plan and first aid kit should be in every classroom. Emergency procedures and phone numbers must be readily available. Teachers should also be aware of the need for special or more specific safety aids such as spill kits, safety shields, safety showers and the ability to provide adequate room ventilation during laboratory activities.

Chapter IV: Personal Safety Provisions. Providing a safe laboratory environment involves a combination of many efforts. Chapter IV provides the information a teacher needs to know about room size, facilities, fire safety, equipment, and proper ventilation. In addition to proper training, procedures, ventilation and emergency equipment, it is important to provide the student with information about personal protection. This information should include the type of clothing

SAFETY IN THE SCHOOL LABORATORY REQUIRES . .

- the availability and, when necessary, the wearing of aprons and gloves.
- care in preventing clothing or long hair from becoming a hazard.
- special attention to prevent eye damage by wearing appropriate goggles.

worn, length of hair and jewelry and proper use of items such as aprons, goggles and gloves.

Chapter V: Safety Strategies in the Classroom. Safety considerations are essential when dealing with students and science activities. This chapter provides information on general and specific safety issues related to science activities. In planning and setting up student activities, it is essential to consider safety issues. During the activity, teachers should move about the room or area where the students are working. They must be familiar with the materials, equipment and procedures that are part of the activity. Access to materials and equipment having the potential for harm or misuse (e.g., chemicals, heat sources, sharp objects) must be controlled. Students should be taught safe practices. A teacher's supervision of students requires a constant alertness to various types of accidents that might occur and the

TEACHERS MAKE LABORATORIES SAFE BY . . .

- **teaching students how to conduct investigations safely.**
- **making sure that safety equipment is functioning and readily available.**
- **being a model for obeying safety rules.**
- **supervising students to ensure that they obey safety rules.**
- **documenting safety instruction.**

exercise of common sense.

Chapter VI: Safe Handling of Equipment. The safe handling and use of materials and equipment should be foremost in the minds of teachers. This chapter provides guidelines for the safe handling and use of a variety of equipment encountered in an educational setting. Teachers and students must be aware of the potential hazards associated with glass and other sharp objects, hot materials or objects, ingestion of harmful chemicals, and electricity.

TEACHERS AND STUDENTS AVOID ACCIDENTS BY...

- **using the proper equipment.**
- **making sure the equipment is clean and in good working order.**
- **receiving instruction in the proper use of all equipment.**
- **practicing proper use of equipment.**

Chapter VII: Chemicals: Managing, Handling and Disposing. Ordering, storing, and disposing of reagent chemicals are important procedures that, when properly handled, contribute to a safe science laboratory. Therefore, all teachers of science need to understand these procedures. Chapter VII presents information about how to order and handle chemicals in ways that help to maintain a safe science classroom. Chemical safety begins with the teacher who orders and uses these products. A teacher considering ordering a chemical for classroom use must understand

MAINTAINING CHEMICAL SAFETY REQUIRES...

- **careful selection of all reagent chemicals.**
- **accurate assessment of relative hazards of chemicals.**
- **proper labeling and storage of all chemicals.**
- **safe use of all materials.**
- **proper disposal of all materials**

the relative hazard level of the chemical, the educational value of using it, their own familiarity with the chemical, and whether the classroom is adequately equipped for the use of the chemical.

VIII. Outdoor Safety - Field Studies. Field studies as a means of experiencing the environment can be a valuable addition to the science program. The greatest value is realized when educational objectives are clearly defined and activities are designed to achieve those objectives in a safe manner. Safety is also achieved when teachers establish and enforce a set of rules, prepare the site prior to the study, and inform students and parents of the scope of the study and the environment in which it is to be conducted. Teachers help ensure safe field activities also when they maintain up-to-date medical information and emergency phone numbers for all participants.

**FIELD STUDIES ARE VALUABLE
EDUCATIONAL EXPERIENCES WHEN
TEACHERS . . .**

- **keep student safety in mind.**
- **establish and enforce rules for safe student conduct.**
- **plan field studies by visiting the site, establishing emergency procedures, and obtaining parental permission.**
- **ensure that specimen collections are legal and serve valid educational purposes.**

IX. Biology and Environmental Science. Some elementary science activities are related to biology and environmental science. There are potential hazards in these areas.

BIOLOGY LABORATORIES ARE SAFE WHEN . . .

- **student safety is considered in determining an activity's value.**
- **proper laboratory techniques are taught and practiced.**
- **physiological measurements are neither stressful nor invasive.**
- **care is taken in selecting and using reagents.**
- **specimens are handled according to professional guidelines.**

Chapter IX contains information on hazards associated with the handling of micro-organisms and animals, classroom activities on the school grounds or outdoor study areas, and containment of biological specimens. The chapter also has information on personal protection devices, classroom safety, microbiology, zoology, botany, biotechnology and greenhouse maintenance and operation. Recognition of potential hazards and development of procedures to avoid or control these hazards are essential

for the completion of safe science activities.

X. Earth Science. Earth/space science offers many possibilities for rewarding elementary school science activities. The activities often involve concepts from chemistry and physics. Chapter X presents information about potential *mechanical* hazards (including rockets, wind generating and force measuring devices), *electrical*,

EARTH/SPACE SCIENCE ACTIVITIES ARE SAFE WHEN . . .

- **activities are selected and planned with student safety in mind.**
- **students are taught the safe use of equipment**
- **protective equipment is available and used as necessary.**
- **care is taken in the selection and use of reagents.**
- **hazards are anticipated and cautions taken to ensure proper functioning of equipment.**

hazards, *chemical* hazards (including a list and description of specific chemicals), *light* (from the sun, lamps and generated by chemical reactions), and *heat* (gas burners, hot plates and candles).

XI. Physics. Many of the hands-on activities in the elementary science classroom deal with the science of physics. This chapter presents general and specific rules for the safe use of materials and equipment that deal with physics. Topics discussed include hazards associated with mechanical equipment (falling weights, objects in motion), electricity (burns, shocks), vacuums and pressures, heat and cryogenics (hot objects, steam, dry ice), certain chemicals, radiation (lasers, ultraviolet light) and rocketry.

PHYSICS LABORATORIES ARE SAFE WHEN . . .

- **activities are selected and planned with student safety in mind.**
- **hazards are anticipated and cautions taken to ensure proper functioning of equipment.**
- **students are instructed in the appropriate use of equipment.**
- **protective equipment is available and used as necessary.**

A. General Safety Practices

1. Make safety an integral part of every science activity. In each class preparation, anticipate potential accidents and problems.
2. Review possible hazards and safety concerns with students before each activity.
3. Practice the experiment before presenting it to the class.
4. Keep students on task and allow ample time for cleanup and waste disposal.
5. Do not allow eating or drinking during a laboratory exercise.
6. Encourage students to wash their hands after each science activity.

B. Chemical Safety Hazards

Laboratory chemicals pose a potential hazard in the elementary science classroom. Most elementary school teachers are not formally trained in chemistry, yet chemicals are sometimes used in their science programs. Many laboratory chemicals have common names that may cause confusion in identifying possible safety hazards.

1. Substances Too Hazardous for Elementary Schools

The following substances should not be used in the classroom because they present too great a safety hazard.

- a. **Acids.** Acids such as hydrochloric, sulfuric, or nitric acid should not be used. Even “dilute” solutions of these acids can cause skin and eye burns. Two acids generally safe to use are vinegar (weak acetic acid) or a weak citric acid solution. When working with acids, always wear chemical splash safety goggles.

- b. **Asbestos.** Asbestos should not be used and should be discarded according to school system policy. Some forms of this mineral – commonly used in heat-proofing applications – is known to cause cancer.
- c. **Bases.** Sodium hydroxide (lye) or potassium hydroxide are extremely strong bases. Even dilute solutions will irritate the skin and, if splashed in the eyes, may cause injury before one can begin to wash the eye out. For acid-base (pH) activities, the teacher should consider sodium bicarbonate (baking soda) when making a basic solution. When working with bases, always wear chemical splash safety goggles.
- d. **Mercury.** Mercury compounds should not be used in the elementary school classroom. Any thermometers or other instruments containing mercury have no place in the elementary classroom and should be properly disposed of. (Mercury thermometers can be identified by their silver-colored liquid.) When thermometers are needed, use alcohol-filled thermometers.
- e. **Smoke Generating Activities.** Smoke of any kind affects the lungs because smoke is composed of particles floating in the air. Any classroom demonstration that produces smoke should be done in a fume hood, near an exhaust fan, or outdoors with students upwind.
- f. **Other Chemicals.** Teachers should use only those chemicals that are on the local school system's list of approved chemicals or those approved by the school system science supervisor. In using an approved chemical, teachers may obtain technical information on the chemical from the Material Safety Data Sheet (MSDS) provided by chemical supply companies.
 - See Appendix C: MSDS: Explanation and Samples.

2. Chemical Safety Practices

Using laboratory chemicals in the elementary science program requires thorough planning by the teacher. The teacher should be familiar with the intended use of the substance, how to handle it safely, and what precautions to use with students.

a. Chemical Labeling

- Label all containers with the substance's common name, precautions, date, and storage area. For each substance, teachers should have available the information listed on the MSDS form.
- Chemicals purchased from major chemical supply companies may have sufficient information on the label (safety warnings and precautions).
- Most elementary "kits" use prepackaged and small amounts of chemicals. These packages may have only the substance name and weight.

- Teachers should not set out the entire container of a material; they should estimate the amount to be used and place it in a labeled container.
- After the laboratory activity, the remaining material in the container should be properly disposed of and not placed back in the stock bottle.
- Substances that have no label and are unidentified should be carefully disposed of in an approved manner.

b. **Chemical Storage**

- Storage areas and containers should be labeled.
 - Access to these storage areas should be limited so that students cannot remove substances from them.
 - Laboratory chemicals should be stored in a cool, well-ventilated room with shelving spacious enough to maintain separation of incompatible substances.
 - If you use flammable liquids, store them in standard safety cans placed in a metal cabinet.
 - Store dry chemicals above liquids, and store oxidizers away from all other chemicals.
 - When transporting chemicals from the storage area to the classroom, use a cart with shelves that have raised edges.
 - Do not allow children to transport hazardous substances.
- See Chapter VII.A.4, Chemical Storage.

c. **Additional Safety Precautions**

- Students should wear chemical splash safety goggles when working with laboratory chemicals.
- Students should be instructed not to taste any laboratory substances and to always wash their hands after use. Provide materials for washing hands at the conclusion of the activity.
- Instruct children not to mix substances at random to satisfy their curiosity.
- Never pipette by mouth. Always use a pipette aspirator bulb.
- Be alert to possible hazards presented by chemicals used in an activity.
- Keep flammable materials (e.g., cooking oil or paper) away from flames.
- Instruct students to smell odors by wafting the odor toward them with a cupped hand.

C. Fire Hazards**1. Fire Types**

The potential for fire is ever present in a school. The table below lists the four classes of fires and methods for extinguishing them:

Class	To Fight Fires Involving	Method to Extinguish
A	wood, paper, cloth	Use water or dry chemical extinguisher.
B	gasoline, alcohol, paint, oil, or other flammable liquids	Smother by using carbon dioxide or dry chemical extinguisher.
C	fires in live electrical equipment	Cut off power to electrical equipment. Use multiple purpose (ABC) or carbon dioxide fire extinguisher.
D	metals (Na, K, Mg, etc.)	Scoop dry sand onto fire.

2. Alcohol Burners

Do not use alcohol burners as they are extremely hazardous. Safer alternatives to alcohol burners include candles, hot plates (models without exposed coils), gas burners, or small portable gas cylinders designed for laboratory use.

3. Effective Safety Practices

In case of a classroom fire, the teacher's first response should be to evacuate the classroom. The teacher should know the location and how to use the nearest fire alarm box as well as fire extinguishers, fire blankets, or other fire fighting aids. The teacher should be ready to react to fires on student's clothing or hair. If clothing is on fire, roll the child on the floor to smother the fire. If a fire blanket is quickly available, it should be used. Water, if immediately available, may be used. Do not direct a carbon dioxide (CO₂) fire extinguisher at an individual because such extinguishers produce dry ice that can cause frostbite. Periodically check on the location and condition of fire extinguishers. Students should tie back long, loose hair, and remove bulky coats that could serve as a potential fire hazard.

D. Eye Protection**1. Goggles**

Use chemical splash safety goggles when engaged in any activities that might pose a risk of eye injury. Safety goggles should be used when–

- using laboratory chemicals in an activity.

- b. using projectiles or sharp objects.
- c. flying particles are likely to be produced (as when solid materials are struck).
- d. when heating materials.

2. **Group Demonstrations**

For group demonstrations, use a safety shield (clear, impact-resistant plastic) to provide additional safety.

3. **Maryland Law**

Maryland law requires that teachers, students, and visitors wear approved and appropriate chemical splash safety goggles when caustic or explosive chemicals or hot liquids or solids are in use. (Annotated Code of Maryland. Education Article, 7-4045).



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Elementary schools may purchase one set of safety goggles to be kept in the school and shared among all teachers. They would be stored with other science equipment. The goggles should be cleaned after each use. There are several ways to clean goggles. If funds allow, an ultraviolet cabinet can be used to store and sterilize the goggles. Alternatively, single-use alcohol wipes can be used to clean all surfaces including the strap. Another alternative is to dip the goggles in a dilute solution of bleach and allow to air dry.

► See Chapter IV.A, Eye Protection Concerns; Chapter VIII.B, At the Site; and Chapter XII.H.4.r, Animal Hazards – Effective Safety Practices.

4. **Eye Safety Planning**

To ensure an effective program of eye safety, teachers should–

- a. establish a plan for storage, cleaning, and distribution of goggles;
- b. discuss with students the need for and appropriate use of safety goggles;
- c. discuss the need for eye safety when planning science activities;
- d. provide eye protection for everyone performing or observing laboratory activities when there is a risk of a hazard to the eyes.

E. **Electrical Hazards**

1. **Hot Plates**

Hot plates are one of the most common electrical devices in the laboratory. Hot plates that have exposed coil wires are not recommended because, when turned on high, the wires become red hot and can ignite a wide variety of combustible materials. Only the solid metal or glass-top hot plates with on/off indicator lights are recommended. Even these types pose risks.

- a. Hot plates should be handled with special care since there is no difference in the appearance of one that is on and one that is off. Even after they have been turned off for several minutes, they remain hot enough to cause a burn.
- b. Electrical cords can fray and crack with age. This condition can lead to electrical short circuits that can cause burns and/or fires.
- c. Electrical cords on the floor or draped across desks create tripping hazards.

2. **Batteries**

Batteries (dry cells), especially the alkaline variety, can cause burns to the skin when a wire is placed across both terminals.

3. **Effective Safety Practices**

- a. Electrical devices used in the laboratory must have a three-prong (grounded) plug. The third wire grounds the metal housing on the device. If you have to use a plug adapter, make sure it is properly grounded.
- b. Electrical plugs should not be modified in any way.
- c. Remind students to remove an electrical plug from a receptacle by pulling the plug, not the cord.
- d. Children should be warned/reminded never to put any object into an electrical outlet. Teachers may want to cover unused outlets with plastic inserts to safeguard against this risk.

F. **Glassware**

1. **Safety Hazards**

Substitute plastic labware for glassware where possible. New plastics like polycarbonate (Lexan®) have been successfully used for laboratory containers. While not useful for heating, the plastic is clear and extremely hard and can be used for almost all water soluble compounds. Beakers, flasks, graduated cylinders, and thermometers now are available in plastic. Check with your science supply company.

2. **Effective Safety Practices**

- a. Always inspect glassware for chips or cracks before and after use. Cracks will eventually work their way through the glass. Discard any cracked item.
- b. Glassware that is to be heated should be made of borosilicate (e.g., Pyrex®).
- c. Remember that hot glass and cold glass look exactly the same.
- d. Never place heated glass items near students.
- e. Never place heated glass items in water.
- f. Do not use glassware designed for science experiments as a container for consumable liquids.

G. Field Trips

1. Safety Hazards

Investigations and experiments outside the classroom are a valuable part of the science experience for the elementary student. The activity must be well-prepared and follow an approved plan.

2. Safety Practices

► See Chapter VIII, Outdoor Safety –Field Studies.

H. Animal Hazards

The use of live animals in the classroom can help students understand and appreciate life processes. Before bringing animals into the classroom, teachers should check the school or school system policy. It is important to select animals that are appropriate to the instructional needs and are practical to maintain. Good safety procedures should be established for the protection of students from the hazards of classroom animals as well as to ensure the humane treatment of animals.

The humane treatment of animals in research and teaching is a sensitive issue. The Council of State Science Supervisors, the National Association of Biology Teachers, the National Science Teachers Association, the Humane Society of the United States, the Animal Welfare Institute, and the National Society for Medical Research all have established guidelines and position papers supporting the safe and humane treatment of animals used for the cause of science.

1. Types of Hazards

Animals in the classroom can be hazardous in several ways.

- a. Animals may contract and serve as carriers for human disease.
- b. Animal scratches and bites can be hazardous to humans.
- c. Animals can be sources of potentially severe allergies.
- d. Animals may adversely affect classroom air quality.

2. Animals Not Recommended

Because the following animals present a high risk of infection and/or injury to humans, they should not be kept in the elementary school:

- a. Any venomous (poisonous) reptiles
 - b. Venomous fish
- c. Black widow and brown recluse spiders
- d. Scorpions
- e. Bees, wasps, hornets, and other stinging insects



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- f. High-risk rabies carriers: bats, skunks, raccoons, foxes, minks, weasels, ferrets, opossums, unvaccinated dogs and cats, and other primates (including apes, monkeys, lemurs, marmosets)
- g. All wild animals – dead or alive (except for those that have been properly prepared through taxidermy or similar professional procedures)
- h. Any animals that can cause an allergic reaction to any student. Check with your school nurse/aide.
- i. Any insect or arachnid (ticks, mites, spiders) capable of carrying disease into the classroom
- j. Household pets

3. Animals Permitted with Caution

The following animals may be permitted but with the noted caution:

- a. Turtles and snakes: possible salmonella infection
- b. Fur-bearing animals: possible cause of allergies and danger of bites
- c. Tarantulas: biting
- d. Parakeets and parrots: source of psittacosis infection

4. Effective Safety Practices

- a. Obtain animals from a certified disease-free source (e.g., a qualified animal distributor or pet shop).
- b. Use heavy gloves when handling animals.
- c. Wash hands and exposed areas of the body with hot water and soap immediately after handling or feeding animals and after cleaning cages. Salmonella bacteria are common to a wide variety of reptiles.
- d. Avoid hand-to-mouth contact when handling animals or cages.
- e. Report any bite, scratch, or equipment-inflicted injury of a student to the school nurse or principal at once.
- f. Rats, rabbits, hamsters, and mice are best picked up by the scruff of the neck, with the hand placed under the body for support.
- g. All mammals used in the classroom should be inoculated for rabies.
- h. Make sure guinea pigs, hamsters, and mice are certified by the vendor as "LCM free." LCM (lymphocytic choriomeningitis) is an uncommon but potentially serious viral disease transmitted to humans from these animals.
- i. Clean and disinfect cages to ensure dry and odor-free care.
- j. Obtain fish from tanks where all occupants appear healthy.
- k. Make provisions for animal care over weekends and holidays.

- l. The animal cage should be constructed of 1/4 inch wire mesh or smaller. A converted aquarium with wire mesh top may prove satisfactory.
 - m. Children should be cautioned never to tease animals or to insert fingers or objects through wire mesh cages.
 - n. When young are to be handled, first remove the mother to another cage.
 - o. Dispose of feces and bedding in a sanitary manner (flush down toilet or seal in plastic bag).
 - p. Do not incubate chicken eggs for hatching unless you have identified a permanent home for the chicks. Be prepared to keep the chicks for three weeks after hatching since Maryland law prohibits giving away or selling chicks less than three weeks old.
 - q. Do not use any animal that has been preserved in formaldehyde. Formaldehyde is a known human carcinogen. When dealing with preserved animals in the classroom, be alert to the possibility that the animals may be preserved in formaldehyde or other toxic substances.
 - r. Specimens preserved in a safe, non-formaldehyde solution should be washed thoroughly before handling, and students should be instructed to use chemical splash safety goggles to prevent eye injury.
- See Chapter IX.D.2.c, Other Guidelines for Working with Animals.

I. Plant Hazards

Plants can be used effectively to provide a living laboratory for elementary school science instruction. By providing experiential learning opportunities, science educators can help students to develop the kind of reasoned thinking that will result in responsible decision-making regarding human/ecosystem interaction. An example of this kind of knowledge is the fact that several poisonous plants, including poison ivy, are also important food for wildlife.

1. Poisonous Plants

- a. Teachers may want to confine their lesson on poisonous plants (poison ivy, poison oak or poison sumac) to pictures.
- b. Before using an outdoor learning area, examine the site for the presence of poisonous plants. When visiting these sites, carefully monitor the children to keep them away from the poisonous plants.
- c. Children should not put any plants in their mouths.

2. Effective Safety Practices

- a. Only plants that are not hazardous to children should be used.
- b. For classroom study, only use plants with which you are familiar.

- c. Treat commercial seeds with care because they may have been treated with toxic fungicides.
- d. Caution children that they should never place any plant or part of a plant in the mouth.
- e. Make hand washing routine procedure after any laboratory activity **S** even when working with plants.

J. Additional Safety Precautions

1. Do not use a thermometer in boiling water unless it is designated for that use.
2. Provide gloves for anyone handling glass wool or steel wool.
3. Do not use reflected sunlight for microscope illumination.
4. Caution children against touching the metal housing of microprojectors as the housing can become extremely hot.
5. When growing microorganisms on agar in petri dishes, proper decontamination/sterilization should be employed before discarding. Once sealed, agar plates should never be opened to examine.
 - ▶ See Chapter IX.C, Microbiology, for proper procedures.
6. When using dry ice, observe these cautions:
 - a. Always handle with gloves or tongs; dry ice can cause burns.
 - b. Do not allow carbon dioxide gas given off by dry ice to accumulate in low areas. The gas is more dense than air and, when it accumulates, can cause asphyxiation.
7. Helium is an inert gas but, if inhaled, replaces oxygen and can cause asphyxiation.
8. Tincture of iodine from the drug store is a satisfactory substitute for iodine crystals for testing for starch.
9. Do not look directly at ultraviolet lamps as the light is dangerous to the eyes and skin.
10. Use alcohol thermometers instead of mercury thermometers. Mercury and mercury compounds are accumulative poisons and should not be used in elementary school.
11. Observe molds in closed containers. Many varieties produce spores that cause allergic reactions or are pathogenic to susceptible individuals.
12. It is important to make the distinction between baking soda and washing soda. Baking soda is sodium hydrogen carbonate (NaHCO_3) and is relatively harmless. Washing soda (or soda ash) is sodium carbonate (Na_2CO_3), a strongly alkaline substance and a strong irritant to the skin and eyes.
13. Caustic soda is sodium hydroxide (lye- NaOH) and an extremely strong base. A strong irritant to eyes and skin, it is not recommended for classroom use.